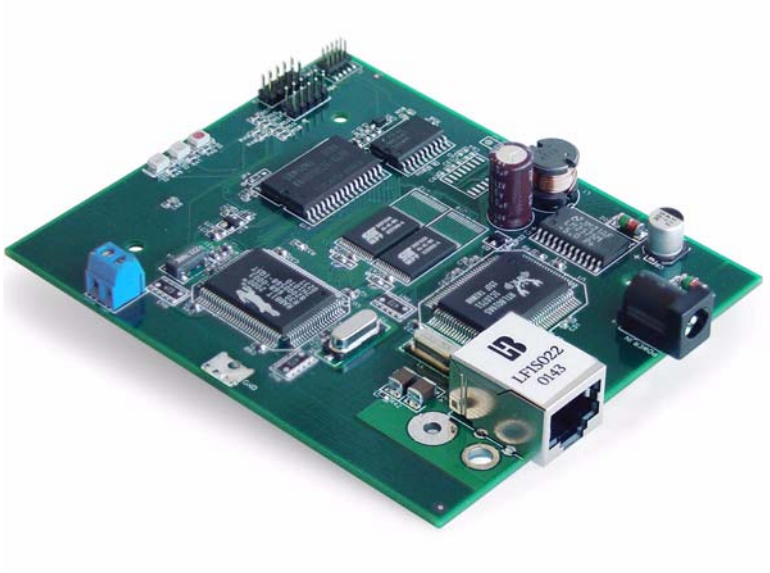
PRODUCT MANUAL



RabbitLink (EG2110)

Network Programming Gateway

User's Manual

019–0123 • 070831–D

RabbitLink (EG2110) User's Manual

Part Number 019-0123 • 070831–D • Printed in U.S.A.

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Rabbit Semiconductor Inc.

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1. INTRODUCTION

This chapter introduces the RabbitLink Network Programming Gateway and describes its features.

Rabbit-based embedded systems are normally programmed using a direct connection between a PC and the programming port of the Rabbit-based system. The RabbitLink provides an indirect connection between the two for remote downloading and debugging of Rabbit-based systems using either the Rabbit 2000 or the Rabbit 3000 microprocessor.

NOTE: The RabbitLink Network Programming Gateway cannot be used in systems based on Rabbit microprocessors other than the Rabbit 2000 or the Rabbit 3000.

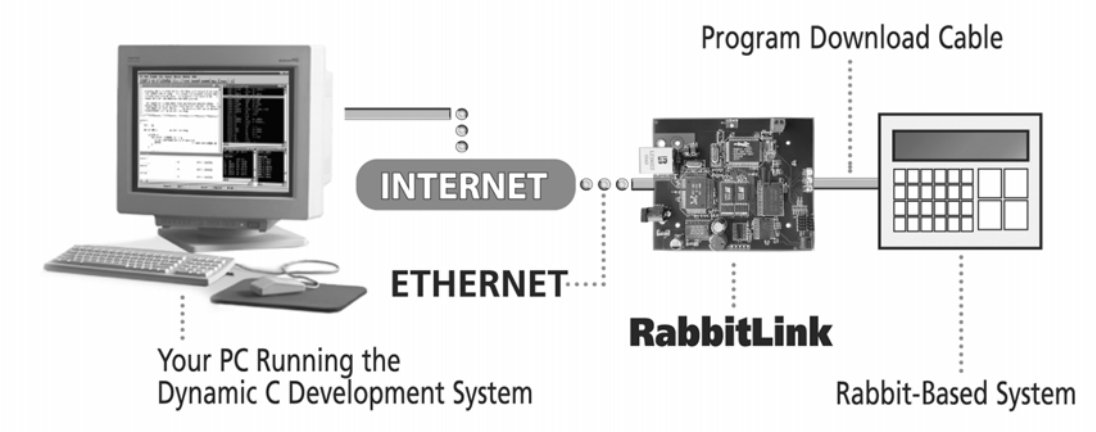


Figure 1. Remote Network Access via RabbitLink Network Gateway

1.1 Overview

Microprocessor boards with a Rabbit microprocessor use a standardized programming connector. Using this connector it is possible to load new software as well as perform the various testing and debugging operations that are part of normal software development. The target can be initialized completely via the programming port without the need for preexisting code stored on the flash memory of the target board. The programming port is a 10-pin 2 mm header (Rabbit 2000-based boards) or a 10-pin 1.27 mm header (Rabbit 3000-based boards). It is connected to a serial port that is a part of the Rabbit processor chip. High-speed data transmission is possible via this port. The programming port is described in detail in both the Rabbit 2000 and the Rabbit 3000 user manuals. If you develop your own Rabbit-based microprocessor board, be sure to include this standardized programming port.

Before the RabbitLink board was introduced the only way to program a Rabbit-based system was via a special serial cable that connects a PC serial port to the Rabbit programming port. This cable, called the programming cable, includes a level translator to convert the RS-232 signal levels on the PC serial port to CMOS logic levels accepted by the Rabbit programming port.

The RabbitLink makes it possible to load and debug programs on a Rabbit-based target via a network, including the Internet. The RabbitLink has an Ethernet port that can be connected to a network or directly to an Ethernet adapter on your PC (using a crossover cable). A programming port out connector on the RabbitLink is connected to the programming port on the Rabbit-based target using the program download cable provided. This connection is shown in Figure 6.

When the RabbitLink is used to connect a target system to a network, communication between the programmer's PC and the RabbitLink is via TCP/IP. Windows-based PCs already support the TCP/IP protocol and Ethernet adapters. There are two separate programs that run on the PC and communicate with the RabbitLink:

- Dynamic C (version 7.03 or later)
- Rabbit Field Utility (version 2.0 or later)

> **NOTE:** The firmware shipped with the RabbitLink model EG2110 is version 2.05. This version of the firmware requires Dynamic C version 7.10 or later and/or version 2.20 or later of the Rabbit Field Utility.

Dynamic C is a complete interactive development environment that allows the user to create, load and test programs on the target system. The Rabbit Field Utility (RFU) is a program that can be used to download .bin program files to the target. The RFU provides a convenient means of updating software on a remote target.

1.2 RabbitLink Features

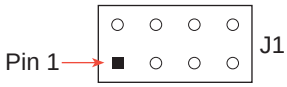
The following is a list of RabbitLink hardware and software features.

- Rabbit® 2000 microprocessor operating at 22.1 MHz.
- RJ-45 Ethernet port compliant with IEEE 802.3 standard for 10Base-T Ethernet protocol.
- 2 serial ports.
- 3 status LEDs, labeled USER, ACT and LINK.
- 128K static RAM and 512K flash memory (two 256K flash chips).
- Optional plastic enclosure and LED light pipes (enclosure and light pipes are included with the tool kit, and are also sold separately).
- Firmware installed, ready to run.
- Downloadable firmware upgrades.
- Easy setup with DHCP or simple console commands.
- Password protection.
- Remote program downloading and debugging.

1.3 Development and Evaluation Tools

The RabbitLink board comes with two *program download cables*. These cables connect a Rabbit-based single-board computer to the RabbitLink board. They are functionally identical, differing in physical size to accommodate different Rabbit-based single-board computers. The RabbitLink Tool Kit (sold separately from the RabbitLink board) contains other hardware that may be used with the RabbitLink.

The Tool Kit contents are:



- *RabbitLink (EG2100) Getting Started* instructions. A black square indicates pin 1 of all headers shown in the manual.
- The programming cable. Connects a PC serial port to the RabbitLink to set up the network parameters and to download firmware.
- AC adapter. Supplies power to the RabbitLink. An AC adapter is supplied with Tool Kits sold in the North American market. If you are using another power supply, a minimum of 9–24 V DC at 120 mA is recommended.
- Plastic enclosure with 4 customer-installable light pipes.
- Screwdriver.
- The companion CD. Contains RabbitLink firmware and the RFU.

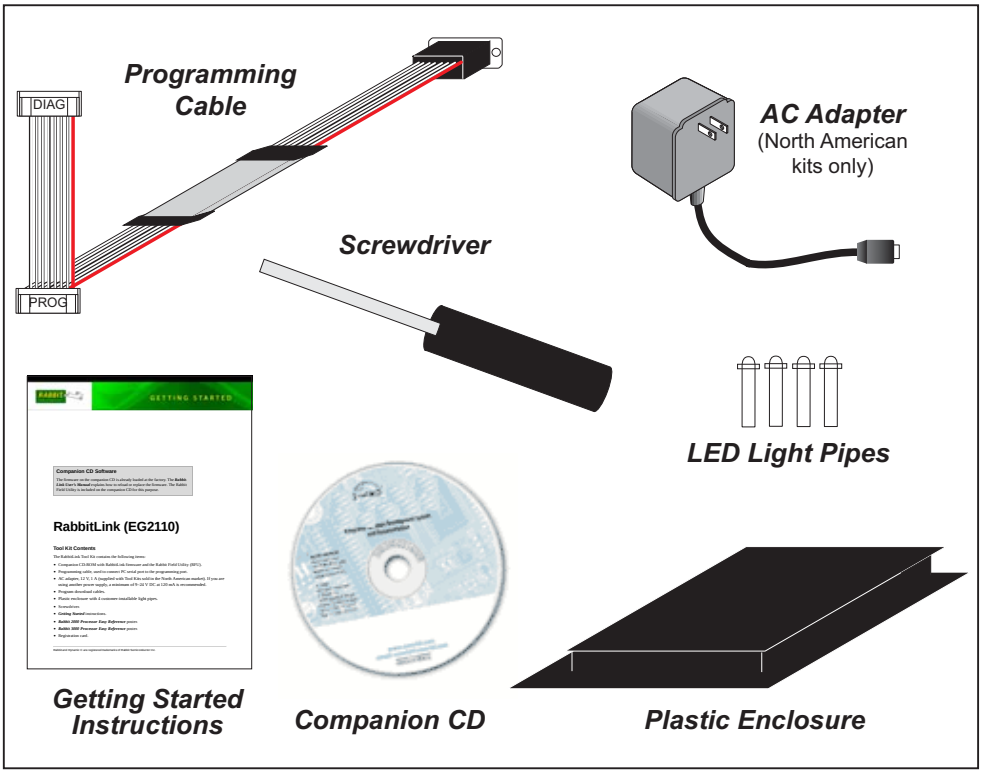


Figure 2. RabbitLink Development Tools

1.4 Software

The RabbitLink board is shipped with firmware already installed in the flash memory. The rows in the following table show which versions of Dynamic C and the RFU are compatible with which versions of the RabbitLink firmware. The firmware version is the same as its serial console; the version number is displayed in the console's startup message.

Table 1. Compatibility Between Dynamic C and the RabbitLink Firmware

RabbitLink Firmware	Dynamic C	Rabbit Field Utility
Version 1.00	Versions 7.03 thru 7.06	Version 2.0
Version 2.00	Versions 7.10 thru 7.26	Version 2.20 and later
Version 2.05	Versions 7.30 and later	Version 2.20 and later

1.4.1 Upgrading Dynamic C

Rabbit Semiconductor recommends upgrading to the latest version of Dynamic C as soon as possible. To use version 2.05 or later of the RabbitLink firmware you need, at minimum, Dynamic C version 7.30.

The simplified structure of version 2.00 and later of the RabbitLink firmware is more flexible and is also more stable and robust than version 1.00. The EG2110 model of RabbitLink is shipped with version 2.05 of the firmware. RabbitLinks (model EG2100) shipped in the 2nd quarter of 2002 have firmware version 2.00. RabbitLinks shipped before the 2nd quarter of 2002 require an upgrade of the firmware to be compatible with Dynamic C 7.10 or later.

Please see Section 3.2.1, "Downloading Firmware to the RabbitLink," on page 20 for complete instructions for downloading the firmware.

1.4.2 Remote Downloading and Debugging

Attaching the RabbitLink to the Ethernet and a Rabbit-based target allows a user to compile, run, and debug programs on the remote board from a network-connected PC running Dynamic C. All the standard features of Dynamic C are available over the remote interface, including the Dynamic C STDIO window, watch expressions, and the ability to step through C and assembly code. Dynamic C can be used exactly the same way as it is for a board connected to the PC's serial port.

To use the RabbitLink, a network address (i.e., IP address) must be assigned to the RabbitLink and the software that runs on the PC must be made aware of this address. Default IP values are set in the firmware and are given here:

- IP address is "10.10.1.100"
- Gateway is "10.10.1.1"
- Netmask is "255.255.255.0"

By default, the RabbitLink will try to get an IP address using DHCP. (DHCP is a protocol to automatically assign IP addresses to computers when they are booted.) The network addresses may be changed using the RabbitLink serial console. Please see Appendix 2.2, "Configuring RabbitLink Network Parameters from your PC," for more information.

If your PC is not connected to a network you may create a network using a hub or you may use a crossover Ethernet cable to make the connection directly from you PC's Ethernet adapter to the RabbitLink card. If you are already connected to a network it may be necessary for the network administrator to assign an IP address to be used by the RabbitLink.

1.4.3 Passphrase Protection

Every time Dynamic C initiates a new RabbitLink session, the RabbitLink requests a passphrase from the user to ensure the security of the programs and data on the remote boards. This passphrase is stored by Dynamic C during that session so it only needs to be entered the first time Dynamic C contacts the RabbitLink gateway. For security reasons, Dynamic C does not store the passphrase on the hard disk of the PC.

1.5 RabbitLink CE Compliance

This section describes the immunity and emissions standards met by the RabbitLink. Design guidelines are given to help developers incorporate the RabbitLink into an application while staying CE compliant.

Equipment is generally divided into two classes.

CLASS A	CLASS B
Digital equipment meant for light industrial use	Digital equipment meant for home use
Less restrictive emissions requirement: less than 40 dB µV/m at 10 m (40 dB relative to 1 µV/m) or 300 µV/m	More restrictive emissions requirement: 30 dB µV/m at 10 m or 100 µV/m

These limits apply over the range of 30–230 MHz. The limits are 7 dB higher for frequencies above 230 MHz. Although the test range goes to 1 GHz, the emissions from Rabbit-based systems at frequencies above 300 MHz are generally well below background noise levels.

The RabbitLink has been tested and was found to be in conformity with the following applicable immunity and emission standards. Boards that are CE-compliant have the CE mark.

CE

Immunity

The RabbitLink meets the following EN55024/1998 immunity standards.

- EN61000-4-3 (Radiated Immunity)
- EN61000-4-4 (EFT)
- EN61000-4-6 (Conducted Immunity)

Additional shielding or filtering may be required for a heavy industrial environment.

Emissions

The RabbitLink meets the following emission standards with the Rabbit 2000 spectrum spreader turned on and set to the normal mode. The spectrum spreader is only available with revision C or higher of the Rabbit 2000 microprocessor. This microprocessor is used in all RabbitLink boards that carry the CE mark.

- EN55022:1998 Class A
- FCC Part 15 Class A

NOTE: The RabbitLink satisfied the Class A limits but not the Class B limits. Such equipment need not be restricted in its sale, but the following warning must be included in the instructions for its use.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Additional shielding or filtering may be needed to meet Class B emissions standards.

1.5.1 Design Guidelines

Note the following requirements for incorporating a RabbitLink into your application to comply with CE requirements.

General

- The power supply provided with the Tool Kit is for development purposes only. It is the customer's responsibility to provide a CE-compliant power supply for the end-product application.
- When connecting the RabbitLink to outdoor cables, the customer is responsible for providing CE-approved surge/lighting protection.
- Rabbit Semiconductor recommends placing digital I/O or analog cables that are 3 m or longer in a metal conduit to assist in maintaining CE compliance and to conform to good cable design practices.
- When installing or servicing the RabbitLink, it is the responsibility of the end-user to use proper ESD precautions to prevent ESD damage to the RabbitLink.

Safety

- All inputs and outputs to and from the RabbitLink must **not** be connected to voltages exceeding SELV levels (42.4 V AC peak, or 60 V DC).

1.5.2 Interfacing the RabbitLink to Other Devices

Since the RabbitLink is designed to connect to other devices, follow good EMC practices to ensure compliance. CE compliance is ultimately the responsibility of the integrator. Additional information, tips, and technical assistance are available from your authorized Rabbit Semiconductor distributor, and are also available on our Web site at www.rabbit.com.

2. GETTING STARTED

This chapter shows how to make the necessary hardware connections and how to configure the network parameters for the RabbitLink.

2.1 RabbitLink Physical Connections

1. Attach the RabbitLink board to the plastic enclosure base.

Position the RabbitLink board over the plastic enclosure base as shown below in Figure 3. Attach the RabbitLink board to the base at the top left and bottom right positions using the two 4-40 × ¼ screws supplied.

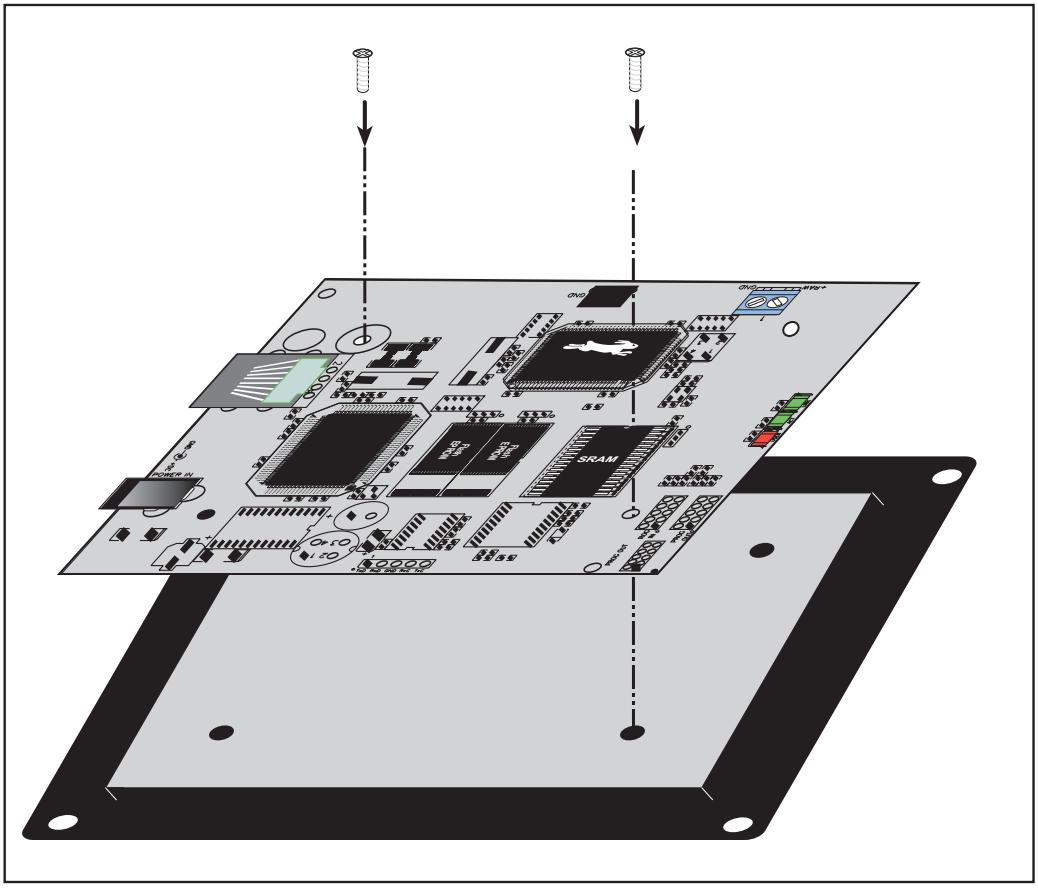


Figure 3. Attach RabbitLink Board to Plastic Enclosure Base

The plastic enclosure base facilitates handling the RabbitLink during development. It is available in the RabbitLink Tool Kit.

NOTE: Appendix B, "Plastic Enclosure," provides additional information and specifications for the plastic enclosure.

2. Connect the programming cable

You must connect the programming cable to configure network parameters from your PC. Connect the 10-pin DIAG connector of the programming cable to header J8, which is labeled PROG IN, on the RabbitLink. Ensure that the colored edge lines up with pin 1 as shown. Connect the other end of the programming cable to a COM port on your PC.

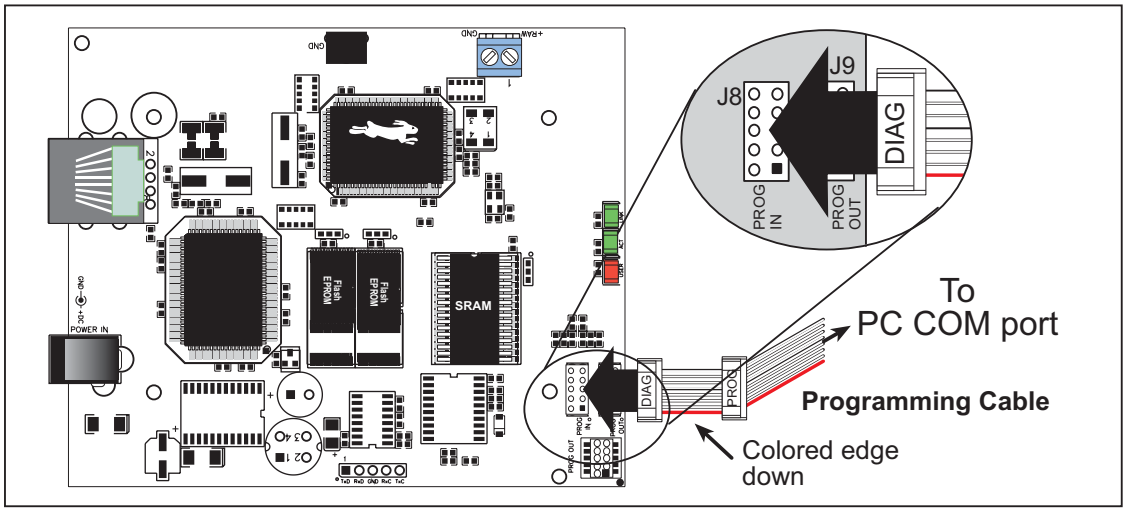


Figure 4. Programming Cable Connections

NOTE: Some PCs now come equipped only with a USB port. It may be possible to use an RS-232/USB converter (Part No. 540-0070) with the programming cable supplied with the Tool Kit. Note that not all RS-232/USB converters work with Dynamic C.

NOTE: Be sure to use the programming cable (Part No. 101-0513) supplied with the RabbitLink Tool Kit—the programming cable has red shrink wrap around the RS-232 converter section located in the middle of the cable. Programming cables from other Rabbit Semiconductor kits are not designed to work with the RabbitLink.

3. Connect the power supply.

Two options are available for powering the RabbitLink. Option 1 is an AC adapter to power supply jack J4; option 2 is a screw terminal header at J5. Option 1 is most convenient in a desktop environment, and Option 2 can be used to connect the RabbitLink to an existing power supply in a field installation. The LED labeled USER comes on for several seconds after power is applied.

Option 1 - Via AC Adapter

Plug the DC end of the power supply into jack J4, which is labeled POWER IN, as shown in Figure 5.

Option 2 - Via Screw Terminal Header J5

Do not do this hookup if you have already connected the AC adapter (Option 1).

Connect the **+** lead (red) to +RAW on header J5 and connect the **–** lead (black) to GND as shown in Figure 5.

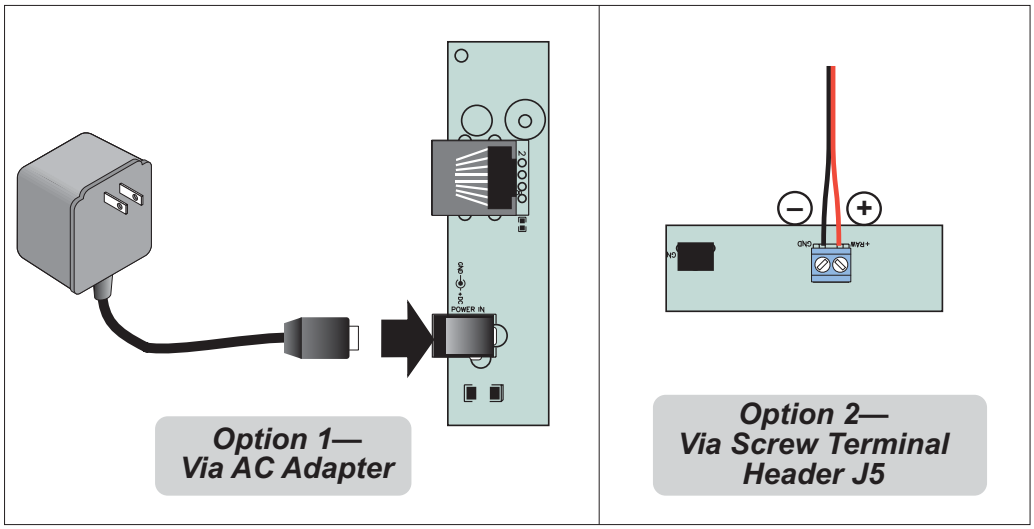


Figure 5. Alternative Power Supply Connections

NOTE: The RabbitLink (2110) has reverse polarity protection through header J5.

4. Apply power.

Once the RabbitLink is powered up and connected to your PC, you are ready to configure the network parameters.

2.2 Configuring RabbitLink Network Parameters from your PC

There are two ways to set the basic network parameters for the RabbitLink: dynamically (DHCP) or statically (RabbitLink serial console). The basic network parameters are:

- the IP address of the RabbitLink
- the IP address of the gateway
- the netmask

2.2.1 Dynamically Assigned Network Parameters

The easiest way to set network parameters is to use a DHCP server. This method is available starting with RabbitLink firmware version 2.00. It removes the need to connect to a PC to configure the RabbitLink, which may be desirable on PCs without a COM port. The RabbitLink tries to use the services of a DHCP server by default.

If there is not a DHCP server on the network, or it is desired to set the parameters by hand, the second method may be used.

2.2.2 Statically Assigned Network Parameters

This method is required for setting anything beyond the basic network parameters. A terminal emulator is used to communicate with the RabbitLink serial console.

1. Open a terminal emulator such as Tera Term or Windows Hypertermal on your PC. Configure the terminal emulator as follows.

Parameter	Setting
COM	Port (COM1 or COM2) to which programming cable is connected
Baud Rate	57,600 bps
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

TIP: If no characters appear when you type, press return, then type `echo on` to turn on the echoing of characters.

2. Cycle power on the RabbitLink. The RabbitLink boots up whenever the power cycles, and then displays the message,

   `RabbitLink Serial Console Version X.XX`

   This may take several seconds, so be patient. The RabbitLink serial console will respond **OK** after each command, or,

   `"ERROR <errnum>"`

   if something went wrong.

3. Configure the RabbitLink network parameters. This is done using the serial console commands. Typing the command “show” results in a listing of the current network addresses.

   Please refer to Appendix E, “Serial Console Commands,” for a description of all the commands. If a DHCP server was not used, the following serial console commands are required:

```
set ip x.x.x.x          // factory default is 10.10.1.100
set gateway x.x.x.x     // factory default is 10.10.1.1
set netmask x.x.x.x     // factory default is 255.255.255.0
```

   An alternative for setting the required network addresses is to change the default values in the RabbitLink firmware, `download.c`.

2.3 Target System Connections to the RabbitLink

After the network addresses have been set, put aside the programming cable and connect the program download cable as shown in Figure 6. Two program download cables are included with the RabbitLink — one is used with 2 mm programming headers, and the other is used with 1.27 mm programming headers. One end of the program download cable connects to the programming header of the Rabbit-based target system. The other end connects to the PROG OUT header (J1 for 1.27 mm programming headers on the target system and J9 for 2 mm programming headers) of the RabbitLink board.

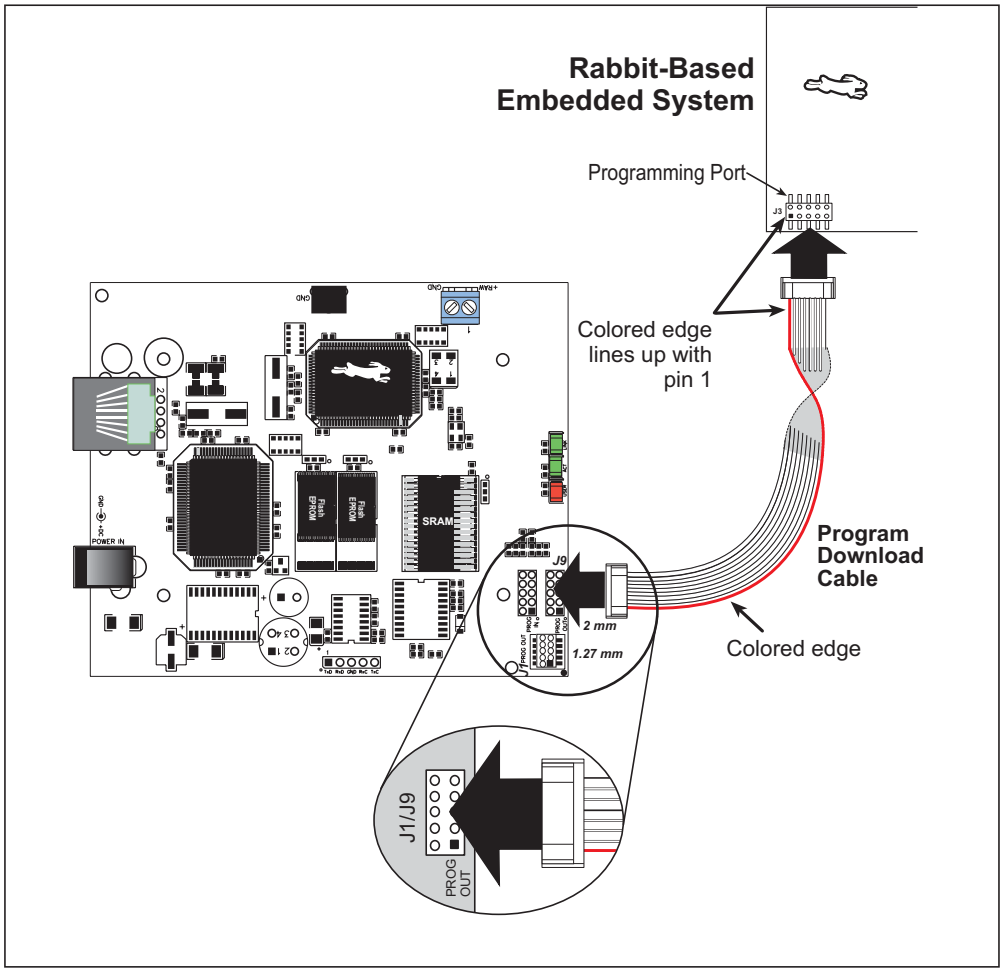


Figure 6. Connect Rabbit-Based Target System to RabbitLink

2.4 Ethernet Connections

Before proceeding, you will need to have either two straight-through Ethernet cables and an Ethernet hub or one Ethernet crossover cable. The Ethernet cables and Ethernet hub are available from Rabbit Semiconductor in a TCP/IP Tool Kit. More information is available at www.rabbit.com.

Your PC must have an RJ-45 Ethernet jack. You can identify the RJ-45 Ethernet jack by looking for an 8-connector (as opposed to a 6-connector RJ-11 phone jack) jack labeled ETHERNET or **<···>** that will probably have an LED or two on it. If your PC does not have Ethernet access, you will need to install a 10Base-T Ethernet card.

Connect your PC and the RabbitLink board to an Ethernet hub as shown in Figure 7. The Ethernet hub may also be connected to your network.

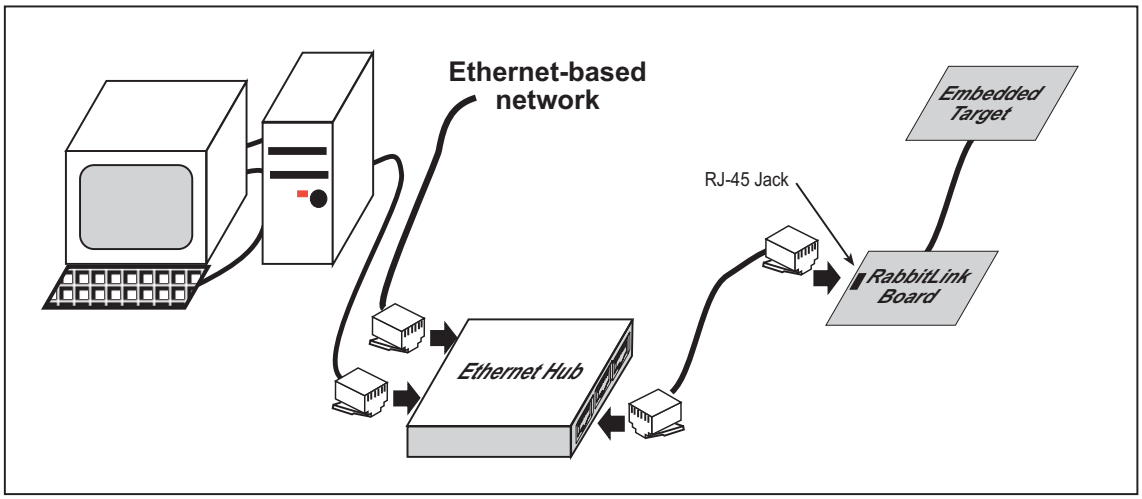


Figure 7. Overview of Physical Connections.

Alternatively, you may use the crossover Ethernet cable to connect the RabbitLink directly to a PC RJ-45 Ethernet jack. This is useful when using RabbitLink as a high speed local programming interface.

2.5 Ready to Go

The green LED labeled LINK should light up once all the connections have been made correctly.

Dynamic C or the Rabbit Field Utility may now be used to download a program to the Rabbit-based target system from your PC. The red LED labeled USER on the RabbitLink blinks while a download or a debug session is in progress.

NOTE: The serial baud rate in Dynamic C must match the baud rate with which `download.c` was compiled.

3. RABBITLINK SOFTWARE

This chapter describes the software functionality available when using a RabbitLink.

3.1 Downloading and Debugging via the RabbitLink

Downloading a program to an embedded target via the RabbitLink is done using Dynamic C or the Rabbit Field Utility (RFU). The rows in the following table show which versions of Dynamic C and the RFU are compatible with which versions of the RabbitLink firmware. The firmware version is the same as its serial console; the version number is displayed in the console's startup message.

Table 2. Compatibility Between Dynamic C and the RabbitLink Firmware

RabbitLink Firmware	Dynamic C	Rabbit Field Utility
Version 1.00	Versions 7.03 thru 7.06	Version 2.0
Version 2.00	Versions 7.10 thru 7.26	Version 2.20 and later
Version 2.05	Versions 7.30 and later	Version 2.20 and later

Before a program can be downloaded to a Rabbit-based target, the RabbitLink must be visible on the network. It must also be visible to Dynamic C or the Rabbit Field Utility (RFU). This is accomplished by setting the network parameters on the RabbitLink board and giving this information to Dynamic C or the RFU.

3.1.1 RabbitLink Network Parameters

Follow the steps in Section 2.2, "Configuring RabbitLink Network Parameters from your PC," on page 13 if you have not already done so. The RabbitLink requires an IP address, a gateway address, a netmask and a port number to communicate across a network.

3.1.2 More RabbitLink Network Parameters

Enter the RabbitLink addresses in the Communications dialog box. Depending on your version of Dynamic C, the Communications dialog box is accessed by choosing it directly from the Options menu or by choosing Project Options from the Options menu and then selecting the Communications tab. From the RFU, the Communications dialog box is accessed from the Setup menu.

- The Network Address field should contain the IP address of the RabbitLink.
- The Control Port field should be set to the TCP port number that the RabbitLink uses to accept control commands from Dynamic C—the default value is 4244. If the RabbitLink is behind a firewall, the Control Port field should be set to the port on the firewall that is being forwarded to the RabbitLink.

If a RabbitLink or multiple RabbitLinks are attached to a local network, press the Discover button in the Communications dialog box to have Dynamic C or the RFU send a broadcast message to each RabbitLink attached to the network. The default UDP port for discovery is 4242. Each RabbitLink will respond with its IP address, name, control port, current status, and MAC address. Selecting any line in the Discover window will cause the information for that RabbitLink to be placed into the appropriate fields in the Communications dialog box.

3.1.3 Password Protection

Though not required, it is highly recommended that the passphrase security feature be activated before the RabbitLink is deployed. This gives some protection to the embedded target system from unauthorized communication. The passphrase may be up to 256 characters long. The serial console command "`set passphrase`" will prompt twice for a passphrase and will store the hashed value of it on the RabbitLink. When a session starts, the RabbitLink will ask for the passphrase, allowing access to the embedded system only after receiving the correct value. If no passphrase is set, just press <ENTER> when asked for it. If you forget the passphrase, the only way to recover is to use the RabbitLink serial console to set a new passphrase. This will require the hardware connections shown in Figure 4 on page 11 and the software setup described in "Statically Assigned Network Parameters" on page 13.

3.1.4 Using Dynamic C or the RFU to Download

Regardless of whether you use the RFU or Dynamic C, downloading across an Ethernet connection is essentially the same as across a serial connection.

The RFU downloads bin files that were previously created using Dynamic C. Dynamic C starts with a source code file and compiles it down to the target.

3.1.5 Remote Debugging with Dynamic C

Once a program is successfully downloaded to the target controller attached to the RabbitLink, Dynamic C may be used to debug the program as if the PC running Dynamic C was directly connected to the target. Refer to the *Dynamic C User's Manual* for detailed information on downloading and debugging.

3.1.6 Troubleshooting Tips

- If Dynamic C is unable to establish communication with the RabbitLink, make sure that the RabbitLink is powered on, and make sure that the Ethernet cable is firmly connected to the RabbitLink and that the LED labeled LINK is on.
- If Dynamic C is still unable to establish communication with the RabbitLink, make sure that Dynamic C has the correct IP address and control port information. Look in the Communications dialog box.
- If Dynamic C is able to establish communication with the RabbitLink, but midway through the download process displays either "**Error receiving Flash ID from target**"or "**Target Communication Error,**" check to make sure that the program download cable is plugged in correctly from the RabbitLink to the controller being programmed, and that the controller is powered on.

3.2 RabbitLink Firmware

The firmware necessary to operate the RabbitLink with a Rabbit-based target system is loaded at the factory. This means that after the hardware connections have been made and the network parameters configured, the RabbitLink is ready to download a program to the local or remote Rabbit-based system.

If it is necessary to reload or replace the firmware, the following `.bin` files are available for download from the RabbitLink directory that was created when Dynamic C installed. The `.bin` files are downloaded to the Rabbitlink using the RFU. The corresponding source files are in the same directory and may be used instead by compiling them to the RabbitLink using Dynamic C.

- **`CLEAR_PARAM.BIN`**—Binary image to reset the network configuration parameters of the RabbitLink board (stored on the second flash) to default values. This binary file is used to reset the serial port if its operation has become undefined.
- **`DOWNLOAD.BIN`**—RabbitLink firmware binary image.

The RabbitLink firmware version must be compatible with the version of Dynamic C that is used to download applications to the target that is connected to the RabbitLink (see Table 2). The companion CD in the RabbitLink Tool Kit contains versions 1.00, 2.00 and 2.05 of the firmware.

3.2.1 Downloading Firmware to the RabbitLink

Follow these steps to reload the firmware or to reset the RabbitLink serial port.

1. Connect the RabbitLink board to your PC as shown in Figure 8 with the PROG connector on the programming cable connected to the PROG IN header of the RabbitLink board.

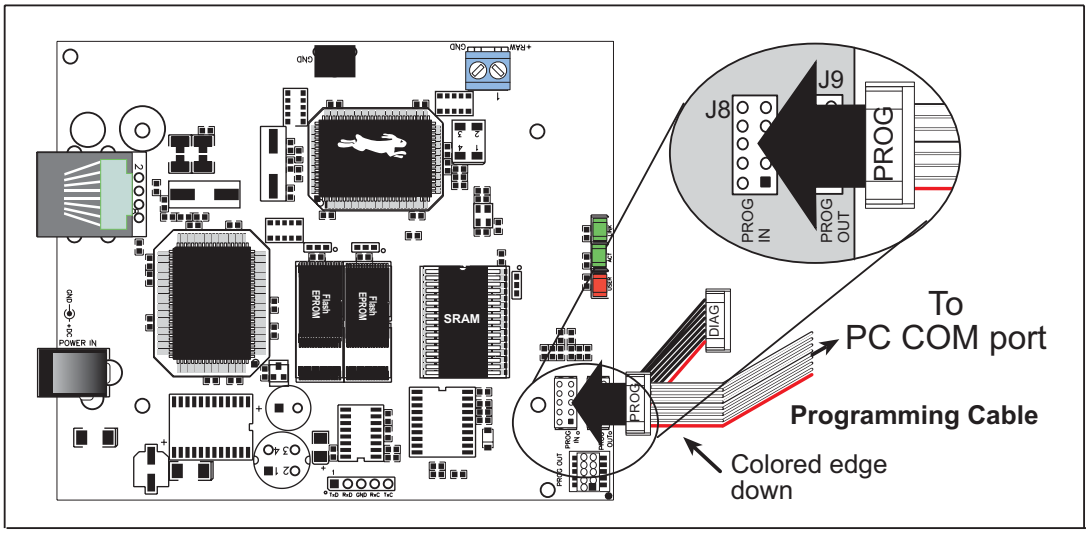


Figure 8. RabbitLink Connections for Downloading Firmware

2. Use the RFU version 2.0 or later to load the DOWNLOAD.BIN firmware or the CLEAR_PARAM.BIN binary image onto the RabbitLink board.
3. Disconnect the programming cable.
4. Unplug the power supply, then plug the power supply back in. This resets the RabbitLink from Program Mode to Run Mode.

3.2.2 Firmware Upgrades

Follow the above steps to install a firmware upgrade. Just substitute the name of the firmware upgrade for the firmware binary image file (DOWNLOAD.BIN). Firmware upgrades will be available at www.rabbit.com.

3.3 Serving Web Pages and Sending E-Mail

The RabbitLink is intended for downloading and debugging across an Ethernet-based network with a Rabbit-based target. However, it is possible to use the RabbitLink to send e-mail and serve Web pages from the Rabbit-based target, though this is not recommended.

3.3.1 Using RabbitLink Features

RabbitLink console commands may be used to send e-mail and serve web pages. A complete list of the available commands are in Appendix E, "Serial Console Commands."

Prior to Dynamic C 7.20, a console function call existed for target applications to send console commands to the RabbitLink. Please see Appendix E.6 for the function descriptions.

Starting with Dynamic C 7.20, the console commands are sent to the RabbitLink through the serial port interface.

APPENDIX A. SPECIFICATIONS

Appendix A provides the specifications for the RabbitLink and describes the conformal coating.

A.1 Electrical and Mechanical Specifications

Figure A-1 shows the mechanical dimensions for the RabbitLink. All measurements are in inches followed by millimeters enclosed in parentheses.

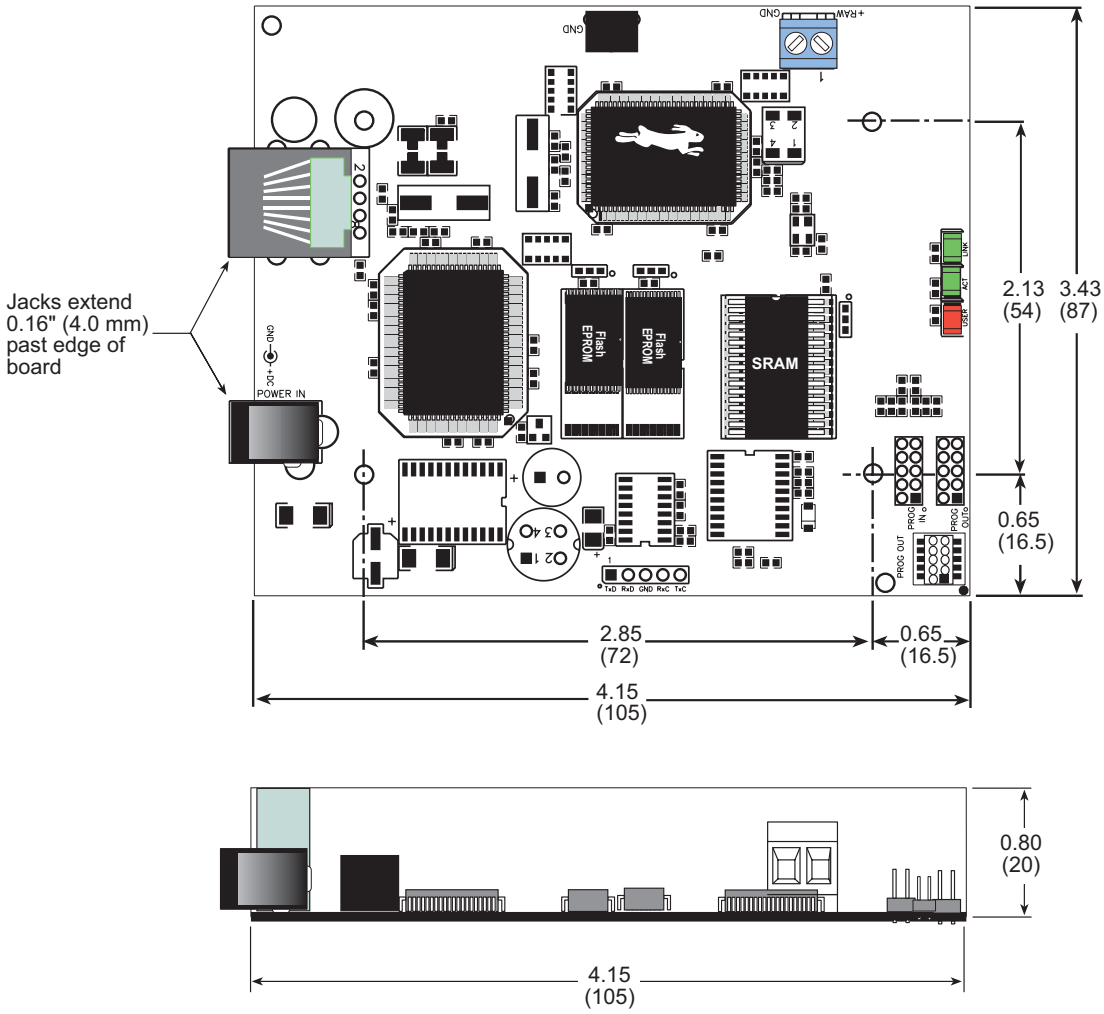


Figure A-1. RabbitLink Dimensions

NOTE: All measurements are in inches followed by millimeters enclosed in parentheses. All dimensions have a manufacturing tolerance of ±0.01" (0.25 mm).

Table A-1 lists the electrical, mechanical, and environmental specifications for the RabbitLink.

Table A-1. RabbitLink Specifications

Parameter	Specification
Board Size	3.43" × 4.15" × 0.80" (87 mm × 105 mm × 20 mm)
Connectors	one RJ-45 (Ethernet) two 2 × 5, 2 mm pitch (serial programming) one 2 × 5, 1.27 mm pitch (serial programming) one contact power jack for AC adapter one 2-terminal screw connector (18 to 26 AWG wire) for wired-in power supply
Ethernet Interface	Direct connection to 10BaseT Ethernet networks via RJ-45 connection
Temperature	–40°C to +70°C
Humidity	5% to 95%, noncondensing
External Input Voltage	9 V to 40 V DC
Current	44 mA at 24 V, 84 mA at 12 V (typical)
Onboard Voltage Regulator	Surface-mount switching regulator sources 5 V at 1 A
Microprocessor	Rabbit 2000™
Clock	22.1 MHz
SRAM	128K, surface mount
Flash EPROM	256K for program plus 256K for data
Serial Ports	2 CMOS-compatible serial programming ports
Serial Rate	Maximum asynchronous 345,600 bps Maximum synchronous 142,700 bps
Watchdog/Supervisor	Yes
Time/Date Clock	Yes
Backup Battery	No

A.2 Conformal Coating

The area around the crystal oscillator and the battery backup circuit on the RabbitLink has had the Dow Corning silicone-based 1-2620 conformal coating applied. The conformally coated area is shown in Figure A-2. The conformal coating protects these high-impedance circuits from the effects of moisture and contaminants over time.

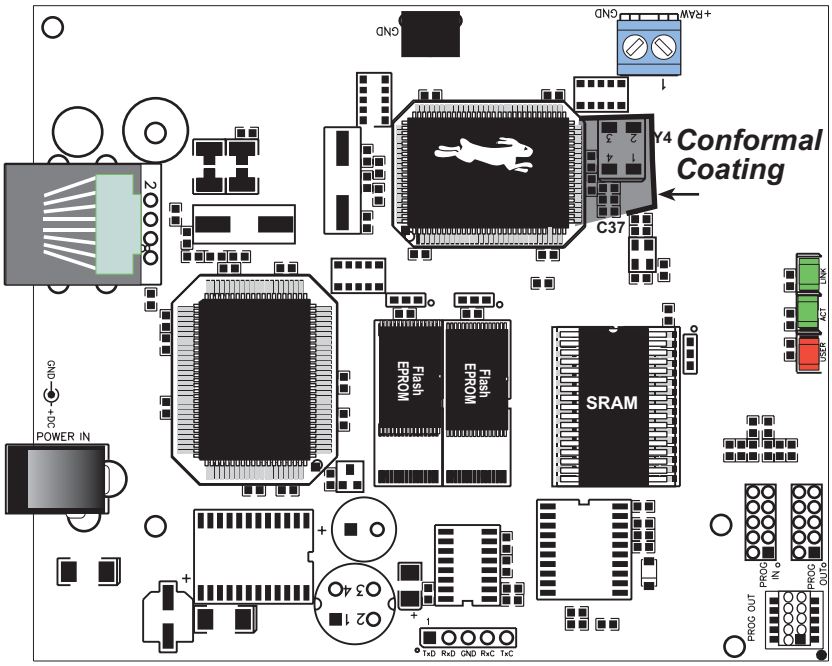


Figure A-2. RabbitLink Areas Receiving Conformal Coating

Any component in the conformally coated area may be replaced using standard soldering procedures for surface-mount components. Apply a new conformal coating afterwards for continued protection against the effects of moisture and contaminants.

NOTE: For more information on conformal coatings, refer to Rabbit Semiconductor Technical Note 303, "Conformal Coatings."

APPENDIX B. PLASTIC ENCLOSURE

The plastic enclosure provides a secure way to enclose your RabbitLink board. The enclosure itself may be mounted on any flat surface.

Appendix B describes how to mount the RabbitLink board inside the plastic enclosure, how to install the optional light pipes, and provides details on mounting the assembly.

B.1 Assembly

1. Attach the RabbitLink board to the plastic enclosure base.

Position the RabbitLink board over the plastic enclosure base as shown below in Figure B-1. Attach the board to the base using the two 4-40 × ¼ screws supplied.

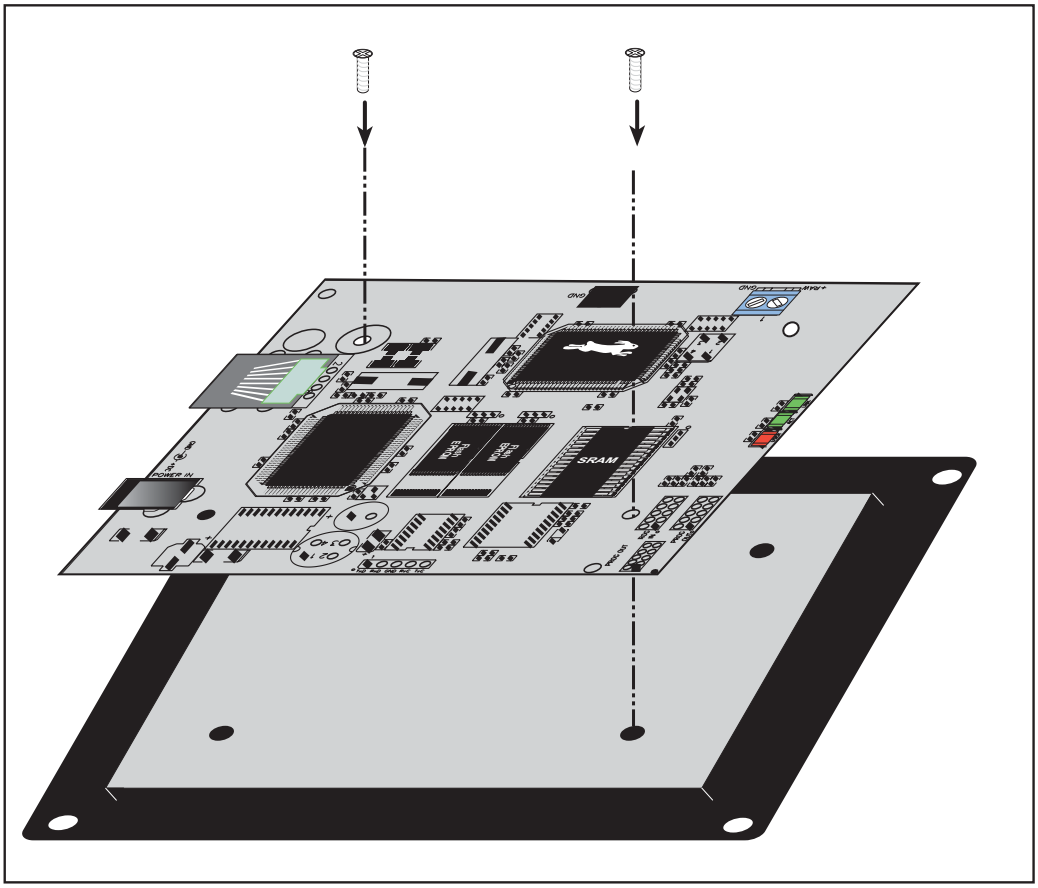


Figure B-1. Attach RabbitLink Board to Plastic Enclosure Base

2. Install light pipes (optional).

Light pipes are included in the tool kit so you can see the LEDs on the RabbitLink board once the enclosure is assembled.

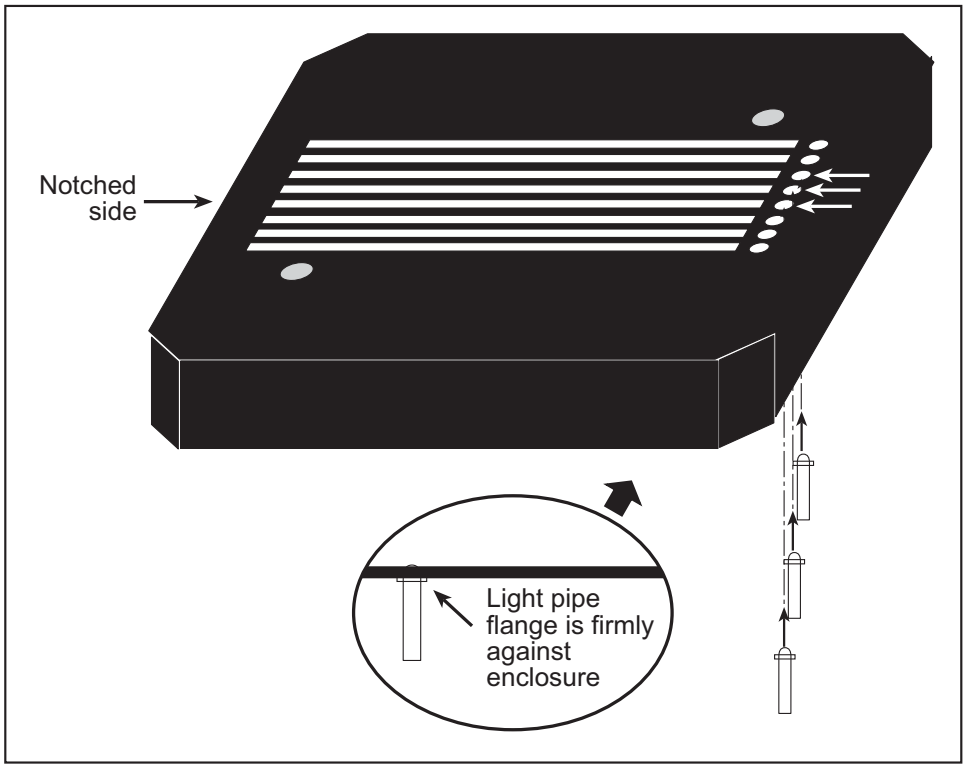


Figure B-2. Install Light Pipes in Enclosure Top

With the enclosure top positioned as shown in Figure B-2, insert three light pipes into the slots identified in Figure B-2. Position the light pipes snugly against the enclosure top since there is little clearance between the light pipes and the LEDs on the RabbitLink board. The light pipes snap in place. Verify that the light pipes are aligned over the LEDs, then apply a drop of cyanoacrylate or contact cement to the inside of the enclosure around each light pipe to hold it in place.

NOTE: Once the glue is applied, it will not be possible to change the alignment of the light pipes without damaging the plastic enclosure.

3. Attach the enclosure top to the base.

Position the enclosure top over the plastic enclosure base as shown below in Figure B-3. Attach the enclosure top to the base using the two 4-40 × ½ screws supplied. If you installed the light pipes, be sure they are aligned over the LEDs as shown.

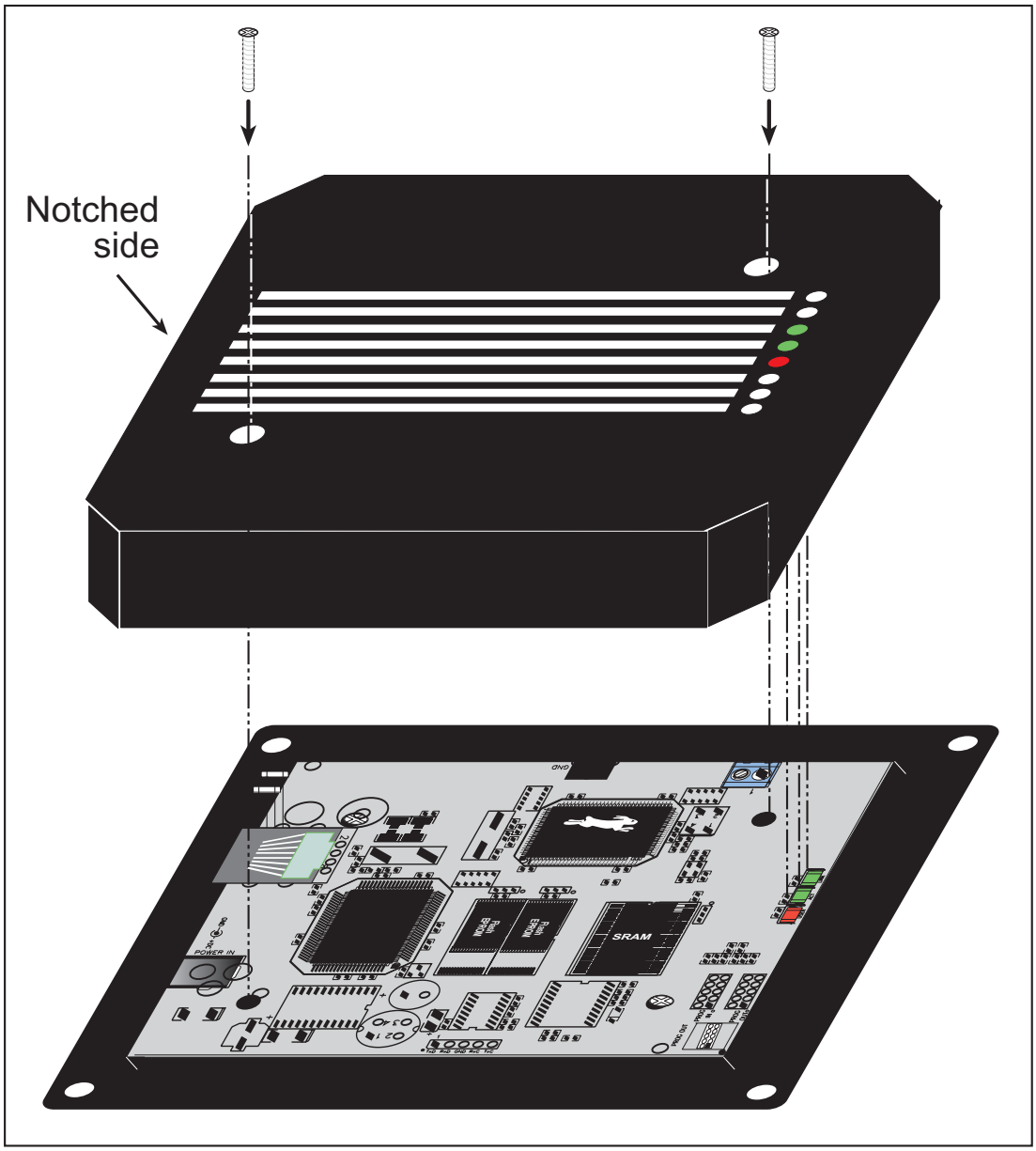


Figure B-3. Attach Enclosure Top

4. Mount plastic enclosure (optional).

Use four #10 screws to attach the assembled plastic enclosure to the surface on which it will be mounted. This step applies to production versions of RabbitLink boards once development has been completed.

B.2 Dimensions

Figure B-4 shows the dimensions for the plastic enclosure.

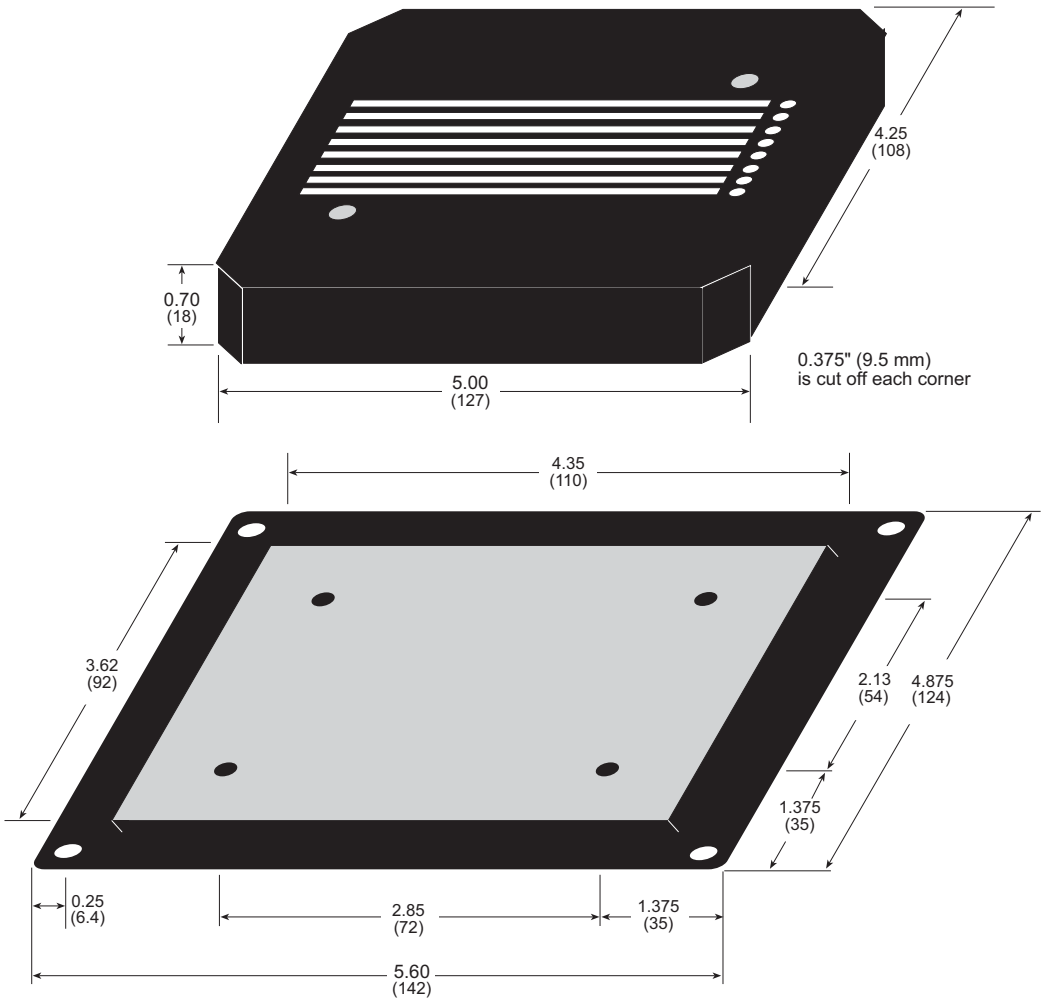


Figure B-4. Plastic Enclosure Dimensions

When fully assembled with the RabbitLink installed, the total height of the plastic enclosure will be 1.1" (28 mm).

APPENDIX C. SUBSYSTEMS

This appendix describes the principal RabbitLink subsystems.

- Serial Communication
- Memory
- Power Supplies
- Reset Generator

C.1 RabbitLink Hardware Subsystems

Figure C-1 shows the Rabbit-based subsystems designed into the RabbitLink and shows the parallel ports and signal lines they use on the Rabbit 2000 microprocessor.

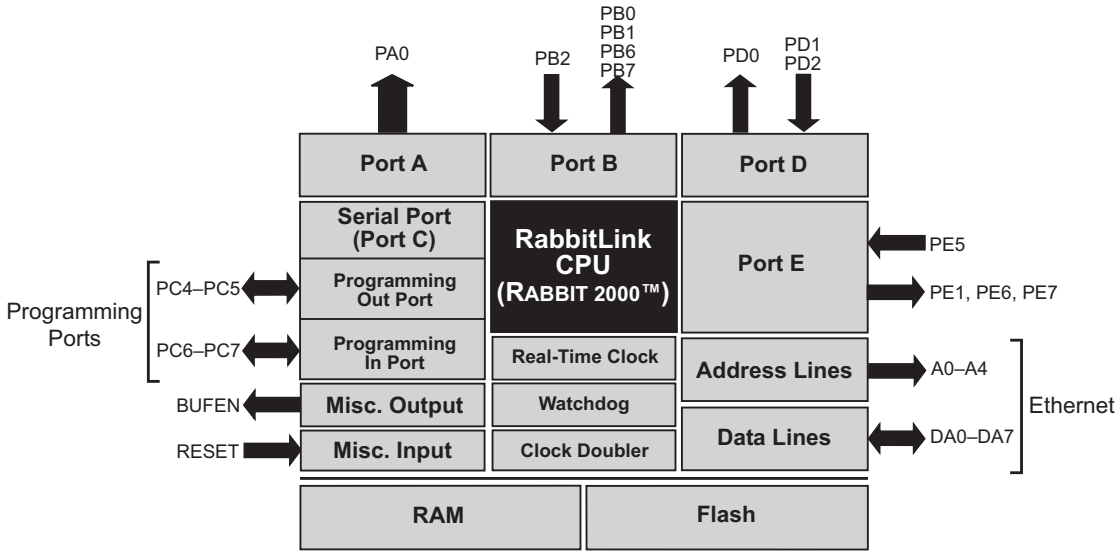


Figure C-1. RabbitLink Subsystems

NOTE: PB0 is an output by default, but can be an input by removing jumper R58 and adding jumpers R59 and R60.

C.1.1 Pinouts

Figure C-2 shows the pinouts for the RJ-45 Ethernet jack and the two programming headers on the RabbitLink board.

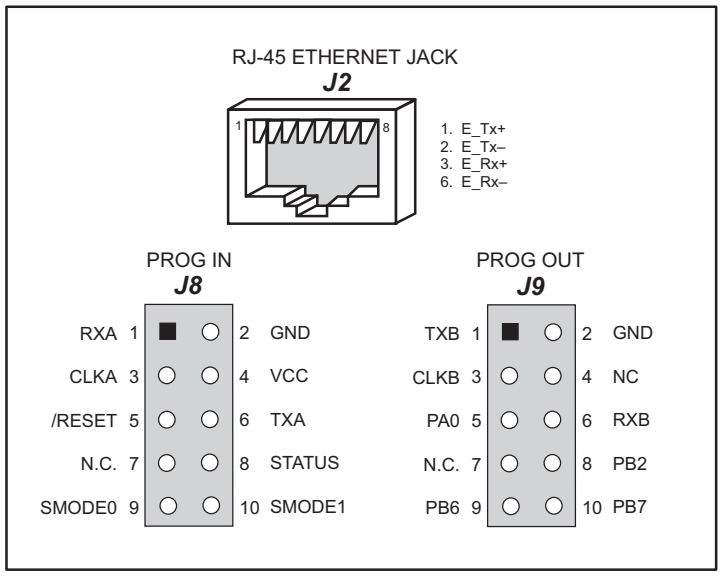


Figure C-2. Pinouts for Ethernet Jack and Programming Headers

C.2 Serial Communication

The RabbitLink uses two serial ports of the Rabbit 2000 microprocessor.

C.2.1 Serial Programming Ports

The RabbitLink board has two 10-pin programming headers labeled J8 and J9. The PROG IN (J8) header uses the Rabbit 2000's serial port A for communication, and PROG OUT (J9) uses serial port B. The Rabbit 2000 startup-mode pins (SMODE0, SMODE1) are presented to PROG IN so that an externally connected device can force a start-up in an external bootstrap mode when the PROG connector on the programming cable is used.

> **NOTE:** Refer to the *Rabbit 2000 Microprocessor User's Manual* for more information on the bootstrap mode.

The PROG IN header is used with the DIAG connector on the programming cable to configure network addresses for the RabbitLink. This connection transmits information to and from a PC running a terminal emulation program. The PROG IN header is also used with the PROG connector on the programming cable. With this connection, you can download firmware to the RabbitLink and also reset default network addresses.

The PROG OUT header is connected with the program download cable to the programming port of the Rabbit-based target. This connection allows the RabbitLink to transmit information to and from the Rabbit-based target. A network-enabled PC running Dynamic C or the RFU communicates with the RabbitLink using the RabbitLink's Ethernet connection. These 2 connections give you the power to remotely download and/or debug an application on a Rabbit-based target.

C.2.2 Ethernet Port

The 10 Mbps twisted-pair Ethernet system allows segment lengths of approximately 100 m for voice-grade twisted-pair telephone wiring. The maximum segment length may be shorter or longer than this, depending on the quality of the twisted-pair cabling in your system. While the 10Base-T system is designed to use voice-grade telephone cable, higher quality Category 5 cables, connectors, and wire terminating devices provide the best possible signal carrying system for 100 Mbps Ethernet media systems.

The 10Base-T media system uses two pairs of wires. They are terminated in an 8-pin (RJ-45 style) connector. Four pins of the 8-pin connector are used as shown in Figure C-2. The transmit and receive data signals on each pair of a 10Base-T segment are polarized, with one wire of each signal pair carrying the positive (+) signal, and the other carrying the negative (-) signal.

C.3 Memory

The RabbitLink has SRAM and flash memory devices. The Dynamic C BIOS handles different standard RAM and flash memory sizes automatically.

C.3.1 SRAM

The RabbitLink is designed to accept 128K or 512K of SRAM packaged in an SOIC case. It comes standard with 128K of SRAM. Figure C-3 shows the locations and the jumper settings for the jumpers at JP4 used to set the SRAM size. The jumpers are 0 Ω surface-mount resistors.

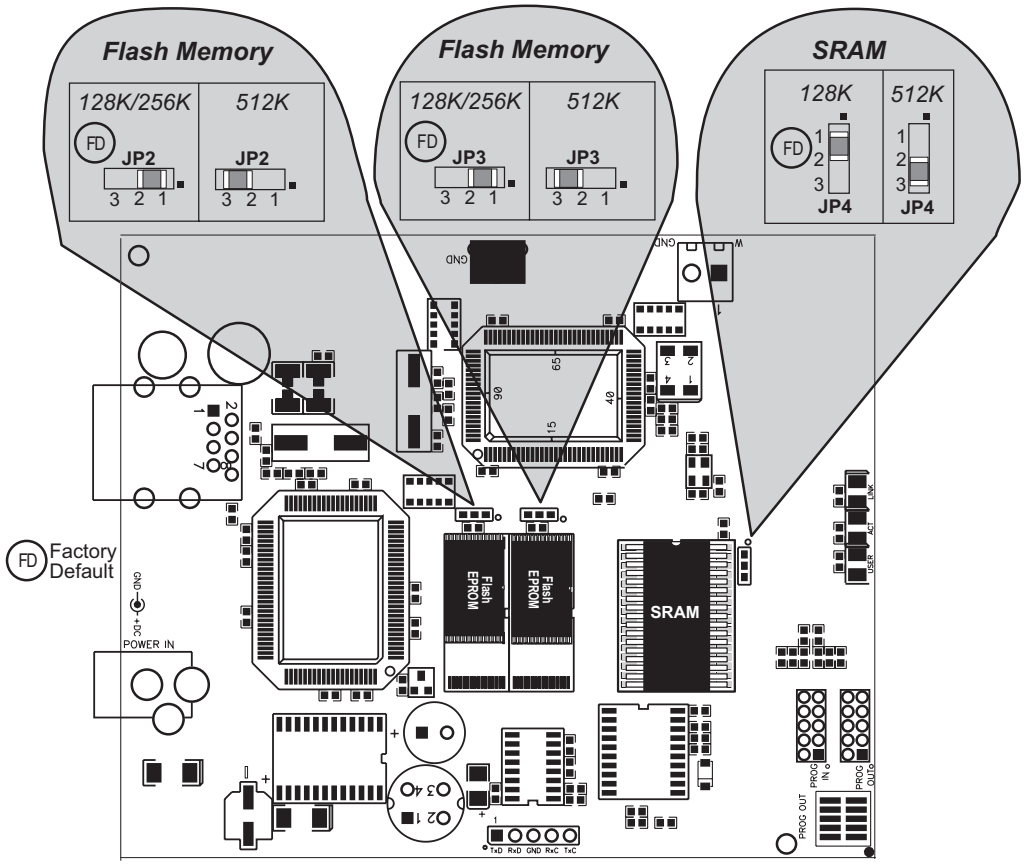


Figure C-3. RabbitLink Jumper Settings for SRAM and Flash EPROM Size

C.3.2 Flash EPROM

The RabbitLink is designed to accept 128K to 512K of flash memory packaged in a TSOP case. It comes with two 256K flash memories, one for the firmware and one for data. Figure C-3 shows the locations and the jumper settings for the jumpers at JP2 and JP3 used to set the flash memory size. The "jumpers" are 0 Ω surface-mounted resistors.

NOTE: Rabbit Semiconductor recommends that any customer applications should not be constrained by the sector size of the flash EPROM since it may be necessary to change the sector size in the future.

C.4 Power Supplies

Power is supplied to the RabbitLink board from an external source either through jack J4 or through screw terminal connector J5. The connection through jack J4 is protected against reverse polarity by a Schottky diode at D1 as shown in Figure C-4.

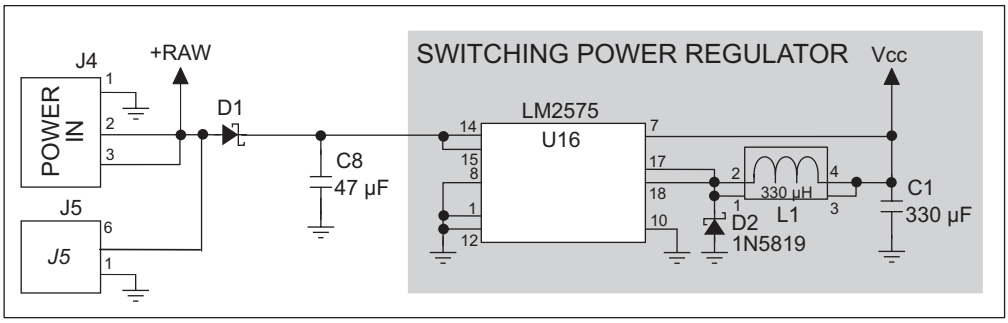


Figure C-4. RabbitLink Power Supply Schematic

The power supply connection through jack J4 is handy for the AC adapter included with the RabbitLink tool kit for desktop demonstration and development. The power supply connection through screw terminal connector J5 enables you to connect the RabbitLink directly to a power supply in the production system.

Capacitor C8 provides noise and ripple stabilization protection for the voltage regulator, and allows the external power supply to be located some distance away from the RabbitLink. A switching power regulator is used. The +RAW input voltage may range from 9 V to 40 V.

C.5 Reset Generator

The RabbitLink uses a reset generator, U14, to reset the Rabbit 2000 microprocessor when the voltage drops below the voltage necessary for reliable operation. The reset occurs between 4.50 V and 4.75 V, typically 4.63 V.

APPENDIX D. PROGRAMMING CABLE

This appendix provides technical information about the Rabbit 2000 microprocessor when connecting the RabbitLink and a PC via a programming cable.

The programming cable has two connectors, labeled DIAG and PROG. The programming cable connects the PC's COM port to the programming port, which is header J8, on the RabbitLink. The programming port pin assignments are shown in Figure D-1.

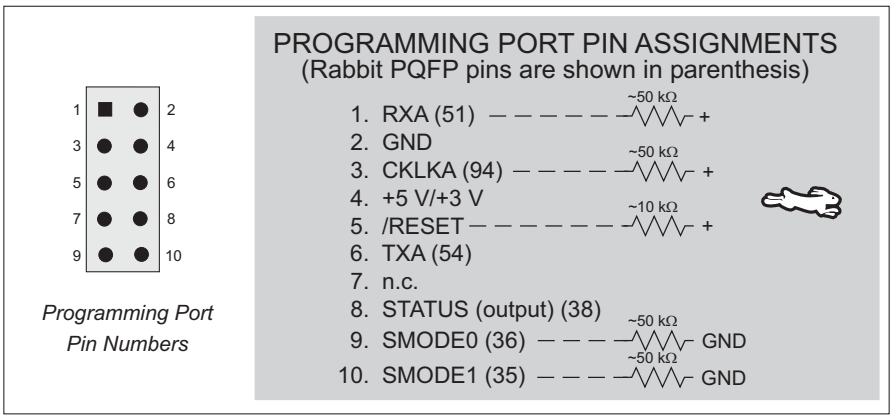


Figure D-1. Programming Port Pin Assignments

The PROG Connector

The PROG connector is used to download firmware to the RabbitLink (see Section 3.2.1, "Downloading Firmware to the RabbitLink"). Using the PROG connector to plug the programming cable into the programming port results in pulling the Rabbit 2000 SMODE lines high. This causes the Rabbit to enter cold boot mode after a reset. The reset occurs when the RFU opens the serial port of the PC with the DTR line high, then changes it to low. This pulses the reset line on the RabbitLink.

In cold boot mode the processor runs a small program contained in an internal ROM. This program receives triplets sent by the PC. It is through this mechanism that the RFU sends firmware to the RabbitLink. Please see the *Rabbit 2000 Designer's Handbook* for a detailed description of triplets and the cold boot mode.

The DIAG Connector

The DIAG connector is used to configure network parameters for the RabbitLink. It is also used to treat the programming port as a regular serial port; because the programming cable contains an active circuit board that converts RS-232 voltage levels used by the PC serial port to CMOS voltage levels used by the Rabbit, the DIAG connector allows the programming cable to be used as an RS-232 to CMOS level converter for serial communication.

The /RESET line and the SMODE1 and SMODE0 pins are not present in the DIAG connector.

APPENDIX E. SERIAL CONSOLE COMMANDS

This appendix describes the RabbitLink serial console commands. The serial console was designed to be human-accessible as a convenient way to setup the network configuration. It is possible to use these commands programatically from the target, though it is not recommended.

E.1 Configuration Commands

These commands are used to set network parameters and to password-protect the RabbitLink.

`set consbaud`

This command sets the baud rate of the console communications.

`57600`	57,600 is the default console baud rate.

`set gateway <IP address>`

This command sets the IP address for the gateway.

`IP address`	The IP address for the gateway in dotted decimal format. The factory default is **`10.10.1.1`**.

`set hostname <name>`

This command allows the RabbitLink to be identified with a unique name, that may be up to 40 characters long.

`name`	User-chosen string. The factory default is **`RabbitLink`**.

`set ip <IP address>`

This command sets the IP address for the RabbitLink.

`IP address`	The IP address for the RabbitLink in dotted decimal format. The factory default is **`10.10.1.100`**.

`set netmask x.x.x.x`

This command sets the netmask.

`x.x.x.x`	This is the dotted decimal format of the netmask. The factory default is **`255.255.255.0`**.

set passphrase

This command will prompt for a passphrase twice to confirm that the passphrase was entered correctly. The characters are not echoed back as a security measure. As another security measure, the passphrase is hashed before it is stored on the RabbitLink. Whenever a new session starts with Dynamic C or the RFU, the user will be asked for the passphrase. It should be as long as possible to increase security, up to the maximum length of 255 characters.

set port x

This command sets the TCP port number. If the RabbitLink is being used behind a firewall, it may be necessary to punch a hole in the firewall to allow remote access.

x	The port number. The factory default is 4244.

set dhcp <on | off>

This command enables and disables the use of any DHCP server that is available on the network. The default condition is **on**. This command is only available with RabbitLink serial console version 2.00 and later.

E.2 Variables Commands

The RabbitLink serial console has the ability to handle SSI (Server Side Includes) variables. These variables are stored in an xmem buffer. This means that the memory will lose the variables when power is cycled, although the references to the variables will still exist. Remember that any HTML file that includes SSI tags must have the file extension **.shtml**.

createv <varname> <vartype> <format> <value> [strlen]

This command creates a variable and stores it in the flash file system on the RabbitLink. The variable can be referenced in HTML files using SSI; e.g. <!--#echo var="var1"-->).

varname The name of the variable.

vartype Type of the variable (**int8**, **int16**, **int32**, **float32**, or **string**)

format The **printf**-style format specifier (such as **%d**) for outputting the variable

value The value to assign to the variable

strlen Maximum length of the string for variables of type **string**.

EXAMPLES

```
createv var1 float32 "%.2f" 3.14
createv var2 string "%s" "This is a test." 50
```

getv <varname>

This command gets the value of the specified variable. The value is printed using the format specifier given in the **createv** command.

varname The variable whose value is requested.

putv <varname> <value>

This command assigns the specified value to the specified variable.

varname The variable whose value is being changed.

value The new value for the variable.

`list variables`

This command lists all the variables by name and type that are stored in the flash file system on the RabbitLink.

`reset variables`

This command deletes all the variables that are stored in the flash file system on the RabbitLink.

E.3 File Commands

delete <filename>

Deletes the specified file from the flash file system on the RabbitLink.

filename Identifies the file to delete.

get <filename>

This command returns the contents of the specified file.

filename Identifies the file.

list files

This command lists all the files in the flash file system on the RabbitLink.

put <filename>
<body of file>
<ctrl-D>

This command sends an ASCII file to the flash file system on the RabbitLink. There is a time-out for this command: the data transfer begins no later than 60 seconds after the RabbitLink senses there is no activity.

NOTE: It is faster and more efficient to transfer all files, including ASCII files, as binary files.

filename Identifies the file.

body of file Everything sent before a <**ctrl-D**> (or a <**ctrl-Z**>) is part of the file contents.

ctrl-D (or a **ctrl-Z**) This is the end of file marker.

put <filename><size>

This command sends a binary file to the flash file system on the RabbitLink. There is a time-out for this command: the data transfer begins no later than 60 seconds after the RabbitLink senses there is no activity.

NOTE: It is faster and more efficient to transfer all files, including ASCII files, as binary files.

filename Identifies the file.

size The number of bytes in the file being transferred.

E.4 E-Mail Commands

mail <e-mail address>
<subject>
<body>
<ctrl-D>

The mail command sends an e-mail via the RabbitLink to the specified address.

e-mail address	The address to which the e-mail is sent; e.g. **rabbit@warren.com**.
subject	After receiving the mail command, the RabbitLink will accept the next string as the subject of the e-mail
body	After receiving the subject of the e-mail, the RabbitLink will accept strings that follow as the body of the e-mail.
ctrl-D	**ctrl-D** (0x04) is the end of the e-mail.

set mail from <e-mail address>

This command sets the RabbitLink's e-mail address. The address will be included in the From line of all e-mail messages sent from the RabbitLink. Any error responses from the SMTP server will be sent to this address.

e-mail name	E-mail address of the RabbitLink; e.g. **rabbit@warren.com**.

set mail server <IP address>

This command sets the IP address of the mail server.

IP address	The IP address of the mail server in dotted decimal format.

E.5 Other Console Commands

`echo <on | off>`

This command toggles the echoing of characters.

`help [filename]`

This command displays the online help.

`filename` This optional parameter limits the help information to that which is associated with the specified file.

`reset`

This command resets the basic network parameters (the netmask and the IP addresses of the RabbitLink and its gateway) to factory defaults.

`show [filename]`

This command lists all assignable variables and their settings, except for the passphrase.

`filename` This optional parameter limits the list of variables to those associated with the specified file.

E.6 RabbitLink Console Function Call (prior to Dynamic C 7.20)

The RabbitLink serial console may be accessed via the serial port using the PROG IN connector on the RabbitLink, as was done in Chapter 2 to configure the RabbitLink.

If RabbitLink firmware version 1.00 is being used, the function calls described in this section will be recognized by the RabbitLink. Prior to Dynamic C 7.20 these functions were in **STDIO.LIB**.

PrintToConsole

```
int PrintToConsole(char flag);
```

This function controls whether Stdio commands such as **printf** go to the RabbitLink serial console in addition to the Dynamic C Stdio window.

PARAMETER

flag	0 – **printf()** and related commands work as normal 1 – **printf()** and related commands go to the RabbitLink serial console as well.

RETURN VALUE

0 if successful, -1 if not.

SendToConsole

```
int SendToConsole(char *data, int length);
```

This function writes a binary buffer of a specified length to the serial console on a RabbitLink. Any data are acceptable since the data will not show up in the Dynamic C STDIO window.

PARAMETERS

data	A pointer to the data to be sent.
length	The length of the buffer passed in data.

RETURN VALUE

The actual number of bytes written to the console.

ConsoleFinish

```
int ConsoleFinish(long timeout);
```

This function finishes receiving data from the RabbitLink serial console by blocking for an optional amount of time to do it. If the timeout is set to 0, the function will not receive any data, but will poll to determine whether there are more data to receive.

PARAMETERS

timeout	The length of time to time out, in milliseconds, and is 0 for **ConsoleFinish()** to determine whether there are more data to receive.

RETURN VALUE

0 if there are more data on the serial console and non-zero if all the data have been received.

LIBRARY

STDIO.LIB

E.7 Example Using the RabbitLink Console Function Call

```
main() {
// first method
SendToConsole("set ip 10.10.2.102\n", 19);
// second method
PrintToConsole(1);
printf("set gateway 10.10.2.1\n");
PrintToConsole(0);
}
```

INDEX

SCHEMATICS

090-0168 RabbitLink (EG2110) Schematic

www.rabbit.com/documentation/schemat/090-0168.pdf

090-0128 Programming Cable Schematic

www.rabbit.com/documentation/schemat/090-0128.pdf

You may use the URL information provided above to access the latest schematics directly.